

Appendix A: Keeping a Laboratory Notebook

Students often wonder exactly what needs to be included in a lab notebook. Your lab notebook serves as an archive of all the data that you produce in the lab, complete with a description of how you obtained the data and how you interpreted your results. Since this notebook is the primary source of raw data, it is often referred to in all types of laboratory settings again and again over time. It is essential, therefore, that enough description of how the experiments were performed and how the raw data was interpreted be included for future reference. Often lab notebooks in commercial or research labs become legal documents used in legal proceedings to establish the basis for a patent claim or litigation, so scientists must learn to keep a clear, well-organized, and careful log of their daily findings in these notebooks.

In order for a laboratory notebook to be a legally valid document, it must be a bound notebook, not a spiral or loose leaf notebook from which pages can be removed. The pages should be numbered and pages should never be torn out. Your entries in this notebook should be chronological, and gaps or blank pages should not be left. You should record the dates of the experiments that you perform. A table of contents in the first few pages of the notebook should include a descriptive title and page number for each experiment in the notebook.

In general, laboratory notebooks must include all the information you might possibly need in the future, even if it seems obvious or trivial at the moment. A laboratory notebook should be complete enough that you or another person could exactly repeat your work based on information in the notebook. It is important that your writing be clear and legible, so that anyone can read and understand your information. Use complete sentences and correct grammar, avoiding indefinite pronouns, in order to make your thoughts clear to others. Make sure that the information that you are recording is complete. Either write down all the steps in the procedure that you followed or refer to the manual where the procedure is found. Be sure to distinguish between what you planned to do and what you actually did. All problems, mistakes, observations, and changes in the procedure should be included in your notebook. Where appropriate, diagrams of equipment and set-ups, chemical formulas, sample calculations, and other illustrations of the work should be included. Record details such as weights of reagents, balances or other instruments used, temperature and humidity (if relevant), dilutions prepared, standards used, etc. Troubleshooting an experiment gone bad is difficult without these essential details.

Raw data should be recorded in clearly explained tables that include headers and the units of measurement for all tabulated data, as well as a title that briefly explains the data. Enter all observations and data directly into the notebook --- not onto a paper towel or the back of your hand. Data should be recorded in ink and should not be altered or edited. When mistakes are made, the error should be simply crossed out and the correction should be written immediately following. A paper output from an instrument or photos can be taped directly into a lab notebook as long as the information is clearly explained.

To make sure that you have included all the relevant information in your notebook, it is useful to follow a standard format for scientific reports which includes an introduction, procedure, results, and discussion section.

- a. **Introduction.** Background information that will assist you in understanding the principles and procedures used in the exercise should be described here. The general approach taken to achieve your objectives for this exercise should be briefly described.
- b. **Procedure.** The materials and methods used in your experiment should be described here. To simplify and clarify the procedure, **use flow diagrams and/or tables** as much as possible. Also, **drawings** are worth pages of words, and will help you to remember how things were done.
- c. **Results.** This is where the raw data is recorded in tables and where any calculations or graphs are done with the raw data. Be sure you describe the data with sufficient detail that anyone reading your book will know what the data represents. Your results should represent exactly what you have observed, and not what you had expected to find.
- d. **Discussion.** Here is where you analyze your results. What did you discover? Did your experiment answer your questions? If not, can you explain why? Did you obtain the result that you had expected? Were there problems in your experiment that rendered a result questionable? How could you have overcome these difficulties in order to obtain better results?

BIOL1406 Cellular & Molecular Biology Lab Report Checklist

1. General format

- Did you use complete sentences and did you use the passive voice?
- Did you begin your sentences with a capitalized word?
- Did you title your sections: Introduction, Procedure, Results, Discussion, and Post Lab Questions?

2. Table of Contents

- Did you write the title of this experiment?
- Did you include the page number where this report begins?

3. Title

- Did you begin your report with a descriptive title?
- Did you include your partners' names?
- Did you include the date that you performed the experiment?

4. Introduction

- Did you describe the purpose for doing this experiment: what you set out to discover and/or the question(s) you intended to answer?
- Did you explain the relevance of the question or discovery that you set out to study?
- Did you summarize the general approach that you took in this study?
- Did you summarize the specialized techniques that were required in this study?

5. Procedure

- Did you describe the equipment used?
- Did you describe the techniques used?
- Did you include important details such as incubation times, incubation temperatures, volumes used, solution concentrations and pH?
- Did you include sample calculations?
- Were your descriptions detailed enough that a biology student from another school could follow your instructions to successfully perform this experiment?

6. Results

- Did you describe and/or draw all observations made during your experiment?
- Did you tabulate all your raw data?
- Did you graph independent (X-axis) and dependent (Y-axis) variables to show mathematical relationships?
- Do your graphs and tables have descriptive titles for data sets?
- Do all your graphs and tables have units of measurement for data sets?
- Do all your figures (graphs and drawings) and titles have titles and numbers?
- Do your graphs with more than one line plotted have a figure legend to identify data sets?
- Did you select the linear range of absorbance plots (where Beer's Law is obeyed) for drawing the best-fitting straight line?

7. Discussion

- Did you analyze and explain all of your raw data?
- Were you able to draw any conclusions from your results?
- Were you able to answer the question(s) that you set out to answer?
- Did you explain why you were unable to answer any questions that you set out to answer?
- Did you include your reasoning for conclusions drawn?

8. References

- Did you need to search the scientific literature (other than you lab manual) for information?
- Did you list your outside sources here?